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ABSTRACT

The use of student proctors or tutors for a Personalized System of Instruction (PSI) has been considered essential; however, the cost of tutorial training programs may be prohibitive. In an attempt to develop an equivalent but less expensive alternative, students (N=219) participated in an evaluation of the use of a VAX computer system as a proctor/tutor in a PSI section of introductory psychology. Half of the students received tutoring from experienced human tutors and the remaining half via an interactive video display from the VAX system. All feedback was limited to the concept and its location within the course's written material which the tutor identified as not having been mastered by the student. Performance on a final exam demonstrated the superiority of PSI over traditional methods but failed to differentiate between tutorial methods. Analysis of detailed questionnaires which covered students' study habits, course organization abilities, and course format preferences revealed that students preferred the PSI method and tutorial method which they experienced compared to other methods available. Further, the questionnaire identified a profile of those students who gravitated toward either the human or computer tutors. Overall, the computer proved to be acceptable as an effective tutor for most of the student population. The format evaluation questionnaire and the pattern of responses are appended. (Author/WAS)

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EFFECTIVE TUTORING IN A PSI COURSE

PERSON vs COMPUTER

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ABSTRACT

Over 200 hundred students participated in an evaluation of the use of a VAX computer system as a proctor/tutor in a PSI section of introductory psychology. Half of the students received tutoring from experienced human tutors and the remaining half via an interactive video display from the VAX system. All feedback was limited to the concept and its location within the course's written material which the tutor identified as not having been mastered by the student. Performance on a final exam demonstrated the superiority of PSI over traditional methods but failed to differentiate between tutorial methods. Analysis of detailed questionnaires which covered students study habits, course organization abilities and course format preferences reveals that students preferred the PSI method and tutorial method which they experienced compared to other methods available. Further, the questionnaire identified a profile of those students who gravitated toward either the human or computer tutors. Overall, the computer proved to be acceptable as an effective tutor for most of the student population.

Keller (1968) held that one of the five essential ingredients in a Personalized System of Instruction was the use of student proctors. These proctors (also known as tutors, facilitators, TA's or teachers) play four significant roles in a PSI course. These include: 1) the administration and evaluation of quizzes, 2) providing feedback or tutoring based on the quizzes, 3) social facilitation and 4) general course administration assistance. Yet the tutor as an "essential" has been questioned. For example, Caldwell, Kishis, Ripley, Farud, Hochstetter and Radiken (1978) attempted to clarify the role of the tutor. They found that tutors had little or no effect on student's performance on final examinations. We, in contrast (Leppmann and Herrmann, 1981), found that feedback given by tutors was an essential ingredient in successful PSI formats. An important difference in our studies and those of Caldwell et al is that our feedback was a simple statement of "informational content" (Robin and Heselton, 1977) while their tutors were not so limited. This brief but specific feedback had been found (Robin and Heselton, 1977) to be more efficient and effective than the traditional techniques of detailed advise or information extraction via probing questions. Unfortunately this type of limited communication requires discipline rarely found among most individuals who serve as tutors. In addition, training tutors to provide feedback in this specific form is both time consuming and expensive (Robin and Heselton,1977). In the modern era of reduced faculty numbers and continually shrinking budgets such luxuries as tutorial training programs may provide an expensive handicap hindering the implementation of a PSI course (Leppmann and Herrmann,1981). We therefore attempted to develop an equivalent but less expensive alternative to the well trained human tutor.

Method

Two hundred nineteen methods enrolled in a PSI section of introductory psychology at the University of Guelph had the option of taking the mastery quizzes under either human or computer tutorial circumstances. The option was restricted in that each method had a capacity of handling approximately half the number of students within the section. Consequently some students were not allowed a free choice but (with their concurrence) forced into the human tutorial option (Note: the computer option was the more popular free choice 142 to 77).

Human tutors were experienced graduate students (i.e. they had performed as tutors over several semesters) and were available to the students during 15 - 1 hour time periods scattered throughout the Monday to Friday teaching week. A VAX computer system designed by Digital Equipment Corporation using a DEC-10 core served as the alternative tutor. The VAX terminals were available 22 hours a day, 7 days a week using a five minute time limit per sign on (for security purposes questions were presented for no more than 30 seconds and quizzes for no more than 5 minutes).

Feedback consisted of simple statements refering the student to the concept and its location within the written material with which the student was having a problem. All administrative and technical information needed by students was provided in 1) a Mastery Guide, 2) a Study Guide and 3) the Textbook used by all sections of the course.

Upon completion of the final examination students were asked to complete a detailed questionaire which we have previously used to provide information about the students behavior in relation to the PSI

option. This questionnaire was given in conjunction with the course evaluation instrument used at this university.

Results and Discussion

The effectiveness of each tutorial method was examined via comparisons of student performance on the final examination (common to all students in our introductory psychology course). Performance on the final exam did not distinguish between the two tutorial methods (Table 1). Yet, performance for each group was significantly better than for students enrolled in the traditional lecture/seminar/discussion sections of the course. This difference of approximately one letter grade (i.e. better than ten grade points changing the average final rating from C to B) was equivalent to what we previously identified as indicating an effective PSI situation (Leppmann and Herrmann, 1981).

Table 1

Analysis of study habits, exam preferences and attitudes toward various instructional formats were examined by comparing the responses to a questionaire which we have previously used in order to obtain detailed background information about the effect of the PSI format (Herrmann and Leppmann, 1982). Analysis of the questionnaire data revealed group differences between PSI students and traditional method students similar to those we have previously reported (Herrmann and Leppmann, 1982) and consequently will not be reported here. Descriptive statistical analysis of the answers of human vs computer students revealed several important differences. These patterns of model responses were identified as significant via a Chi-square analysis of response frequencies.

Table 2

In general PSI students report spending more time studying than their traditional teaching method sections counterparts. But computer facilitated students report that they prepared more systematically than the human facilitated students.

Table 3

This same pattern was not only found in the preparation of modules but in preparing for midterm examinations. Computer students reviewed the material rather than crammed. Human tutored students remained less systematic but still more systematic than non-PSI students.

Other relevant comparisons reveal that: 1) computer students were specializing in the natural or biological sciences, 2) female students usually chose the human option while males chose the computer, 3) computer students found the study guide as more helpful during their preparations than did human facilitated students, 4) human option students found the facilitator provided feedback was the most helpful ingredient in their preparations, and 5) computer option student believed that module test covered the main points of a module far more often than did human facilitated students. Most interesting the extensive details necessary to operate the computer were found to be far simpler than the brief instructions necessary to complete the human facilitator connection. As a whole these results clearly indicate that the nonhuman tutor is an efficient method of providing mastery testing and effective feedback. It is most interesting to note however that both the human facilitators and the computer were well liked by their users.

A post hoc cost and time analysis of both methods of tutoring reveal that the computer was considerably cheaper and more efficient. The computer could handle more students conveniently than could human facilitators. The computer was able to handle more students, more often and at less cost than the human facilitator option. The mechanical nature of the human-computer interaction did not negatively effect the advantage gained under the PSI option. This finding is not affected by the computer students' perception of increased quiz difficulty. In fact, despite this perception, computer students made the same average number of attempts per module to demonstrate mastery.

In summary, feedback is necessary for successful PSI performance. But that feedback does not have to come from a human tutor.

Table 1

	No. of students	Grade	
		$\bar{X}$	SE
Lecture Seminar	148	65.21	1.20
PSI - Facilitator	107	79.08	1.08
PSI - Computer	112	79.47	.93

TABLE 2

INTRODUCTORY PSYCHOLOGY

FORMAT EVALUATION QUESTIONNAIRE

Note: None of the information given on this questionnaire will affect your grade in this course. In fact, the questionnaire is confidential and will not be processed until after the grading for the course has been completed.

1. In retrospect, I would have preferred to have this course by

   1. the standard lecture/seminar format
   2. an evening section (totally lecture)
   3. the audio visual tutorial section
   4. staying where I am

2. Compared to other courses at this level, this course demanded_____ time and effort.

   1. less
   2. as much
   3. more

3. The average time I spent studying for this course each week was:

   1. less than 1 hour
   2. less than 2 hours
   3. less than 3 hours
   4. more than 3 hours

4. I find that the (PSI on Lecture/Seminar)* method used in this course

   1. requires less effort than courses which use the (PSI or Lecture/Seminar)* method
   2. requires as much effort as courses which use the (PSI or Lecture/Seminar)* method
   3. requires more effort than courses which use the (PSI or Lecture/Seminar)* method

5. The use of this method in this course will probably result in my:

   1. getting a lower grade
   2. getting the same grade
   3. getting a higher grade

6. If you had your choice would you like to see this method applied to your other courses?

   1. no
   2. makes no difference
   3. yes

7. When studying for a course

   1. I have little trouble organizing the material
   2. I need some help organizing the material
   3. I use the organization provided by the textbook
   4. I need a lot of help in organizing the material

8. I prefer courses which:

   1. have a formal and consistent organization of the material
   2. present a framework within which the student can organize the material
   3. leave the students to organize the material as they wish
   4. are totally informal with both content and structure evolving from the course itself

9. In general I prefer courses which:

   1. use a text(s) which contains all information for the course
   2. use of text(s) for the major portion of the required information
   3. use reference materials which give access to the information required by the course but presented in lecture
   4. use no texts with the professor providing all information

10. I prefer courses which:

   1. examine only on textual material
   2. examine on both textual and lecture material
   3. examine only on lecture material
   4. do not have examinations but require term papers or projects

11. I prefer

   1. multiple choice examinations
   2. fill in the blanks or other short answer questions
   3. essay type examinations
   4. oral format examinations

12. How do you normally prepare for examinations?

   1. Not at all
   2. In no particular manner
   3. Concentrated cram sessions as close to the exams as possible
   4. Increased studying as the exam approaches
   5. Systematically organizing the course on a week to week basis

13. How did you prepare for (Modules/Seminars)*?

   1. Did not prepare at all
   2. By reviewing the summary material available
   3. By intensive studying before the event
   4. Systematically over the week

14. How did you prepare for the midterm examinations?

1. Not at all
2. By reviewing the chapter summaries and glancing at my notes
3. By intensively studying before the exam
4. By increased studying as the exam approached
5. Systematically on a week to week basis

15. My degree program is

1. B.A.
2. B.Sc.
3. Other

16. I am

1. male
2. female

* As appropriate

The following questions are to be answered by PSI students only

17. What is your general opinion about the module method

1. I don't like it less than the lecture method
2. I like it as much as the lecture method
3. I like it more than the lecture method

18. I found the module tests to be:

1. very easy
2. easy
3. fair
4. difficult
5. very difficult

19. I found the questions on the module tests_____covered the main points of the module.

1. always
2. often
3. usually
4. sometimes
5. never

20. I found the feedback given me to be

1. useless
2. helped a little
3. helped
4. helped a lot
5. extremely helpful

21. I found the study guide to be:

    1. useless
    2. helped a little
    3. helped
    4. helped a lot
    5. extremely helpful

22. I found the mechanical details of the course (study guides, computer operating instructions, module quiz schedules, midterm schedules) to be:

    1. baffling
    2. difficult to understand
    3. understandable
    4. easily understood
    5. simple

23. If I had had the opportunity I would have preferred to switch methods of taking the module tests (i.e. facilitator to computer or computer to facilitator).

TABLE 3

QUESTIONNAIRE RESPONSE PATTERNS

Question	Model Responses*		
	L/S	PSI	
		Computer	Facilitator
1. In retrospect, I would have preferred to have taken this course by	same	same	same
2. Time and effort required compared to other courses at this level	same	more	more
3. Time spent studying each week	<3 hours	>3 hours	>3 hours
4. Amount of effort required compared to other method (L/S vs PSI)	same	more	more
5. Method will result in a grade which is	same	higher	higher
6. Apply to other courses	no/no difference	yes	yes
7. Help needed for organizing a course	need help	little	little
8. Prefer course organized by	formal	framework	framework
9. Information source preferred	text for most	text	text
10. Exam material preference	text/lecture	text	text
11. Exam type preference	multiple choice	multiple choice	multiple choice
12. Normally prepare for exams by	increase as exam approaches	increase as exam approaches	increase as exam approaches
13. Prepared for modules/seminars	cram	systematically	cram/ systematically
14. Prepared for midterms	cram/increase as exam approaches	review/increase	cram/increase

*answer/s accounting for greater than 2/3 of the responses.

Question		Model Responses		
		L/S	PSI	
			Computer	Facilitator
15.	Degree program	B.A.	B.Sc.	B.Sc.
16.	Gender	female/male	male/female	female/male
17.	General opinion about the module method	N/A	like	like
18.	Module tests were	N/A	difficult	fair
19.	Module questions covered main points	N/A	always/often	usually
20.	Feedback helped	N/A	little help	helpful
21.	Study guide	N/A	most helpful	helped a lot/ most helpful
22.	Mechanical Details	N/A	easily understood/simple	easily understood/ understandable

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